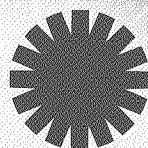


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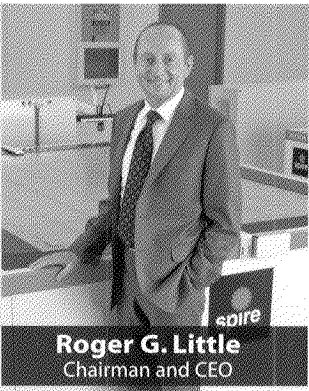
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Washington, DC 20549

**a global solar company**

[www.spirecorp.com](http://www.spirecorp.com)

## Dear Stockholders, Customers and Employees:



**Roger G. Little**  
Chairman and CEO

Spire reported record revenues of \$69.9 million in 2009, an achievement that was accompanied by significant accomplishments in our core solar business. For instance, we delivered a fully-automated 50 megawatts (MW) per year module assembly line to Martifer Solar in Portugal and a 30 MW per year solar cell line to Hanwha International in

Korea. We also sold our hemodialysis catheter business to Bard Access Systems as part of the Company's strategic initiative to focus on the global solar industry. Sales of our solar products and services are expected to account for more than 90% of our revenue base in 2010.

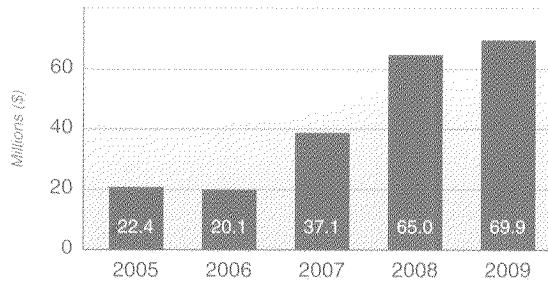
Despite a temporary slowdown in the industry's rate of growth in 2009, the solar market continues to expand at a rapid pace. The worldwide photovoltaics (PV) market achieved a record high

6.1 GW of new installations in 2009, and industry analysts predict over 9 GW of new installations in 2010. The United States (U.S.) market is growing at an even more rapid rate, driven in part by the American Recovery and Reinvestment Act of 2009 (the Stimulus Bill), and also by Purchase Power Agreements (PPA) and state incentive programs. The U.S. has now become the third largest PV market in the world.

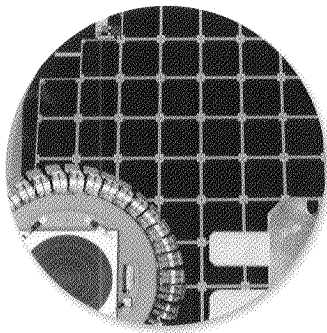
Spire Solar provides industry-leading PV manufacturing equipment to this rapidly expanding market. We sell both individual equipment and turnkey production lines. Sales of our solar simulators were particularly robust in 2009. Many manufacturers consider Spire's simulator to be the standard in the industry. We also identified opportunities and secured contracts for "special situation" turnkey lines, such as those for the U.S. prison system, and believe that the market for these types of lines will continue to grow. Spire continues to offer raw materials, such as solar cells, to its turnkey equipment line customers.

We reinitiated our Spire Solar Systems business in 2009 and expect it to rapidly contribute to revenue and operational profits. The U.S. domestic market for systems is positioned for substantial growth, and pursuing this market will

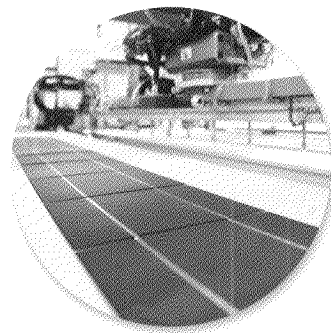
*Spire Corporation Total Annual Revenues*



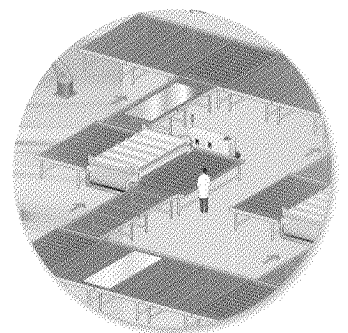
## Spire Corporation



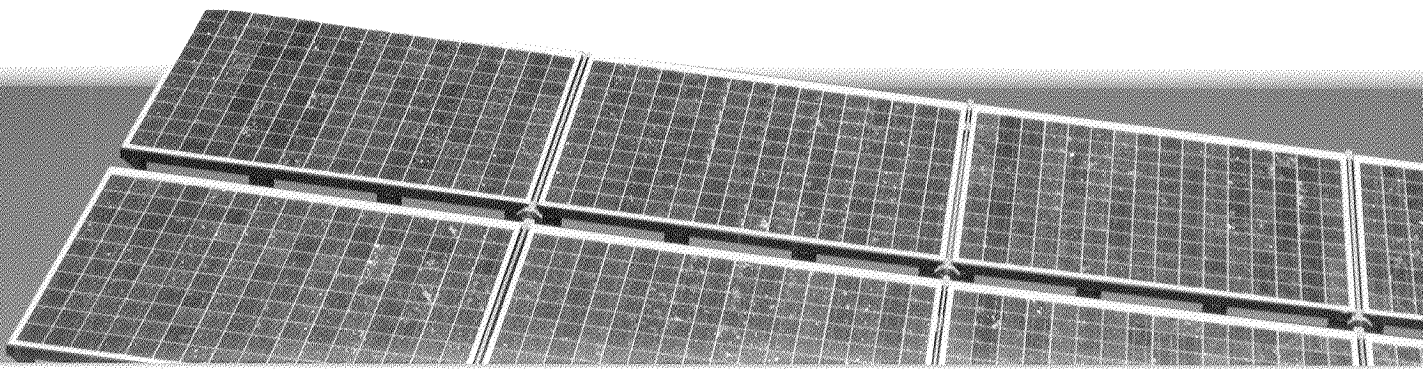
**Research & Development**



**Spire Solar Equipment**



**Turnkey Solar Lines**



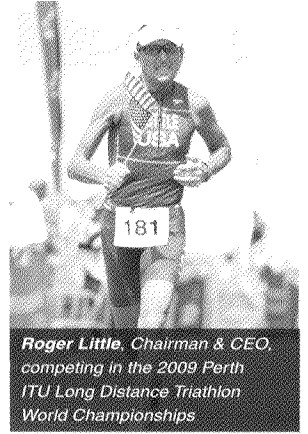
enable us to leverage our knowledge of the module market supply chain. The systems business also provides a convenient built-in customer base for our own module line customers.

Spire continues to look forward, relying on its heritage of innovation to drive future opportunity. For instance, we are developing specialized turnkey lines tailored to applications such as high efficiency back-contact cells, building-integrated photovoltaics (BIPV), and large area module production. In particular, we see opportunity for large-area 1 kW modules to be used in downstream integration of utility-scale "solar farms." We are continuously improving our module line equipment, striving for industry-leading status, and focusing on quality, high-yield and maximum throughput. Furthermore, our subsidiary, Spire Semiconductor, continues to achieve and surpass its DOE/NREL-established milestone targets in the development of high efficiency, multi-junction concentrator solar cells, currently nearing world record cell efficiencies.

The slowdown in the U.S. economy and global recession affected our business operationally in 2009. The Company recorded a net loss of \$5.3 million for the year, compared to net income of \$4.8 million for the same period of 2008. We were, of course, disappointed in this result, which was mostly driven by delays or cancellations of several equipment and line orders due to a slowdown in our customers' expansion plans. This resulted in

underutilization of our manufacturing capacity, eroding gross margins. However, we have taken steps to reduce costs. We reduced payroll and corporate expenses and renegotiated a number of contracts giving us more favorable terms. With these restructuring efforts and anticipated higher revenues, we expect improved operational performance in 2010.

In summary, Spire is well positioned to take advantage of the rapidly growing global and U.S. solar markets. Our range of integrated PV products and services is unique to the industry. Combined with continued innovation, this ensures Spire a prominent position in the market for many years to come. We are looking forward to Spire's future as part of the unprecedented growth phase in this exciting industry.



**Roger Little, Chairman & CEO,** competing in the 2009 Perth ITU Long Distance Triathlon World Championships

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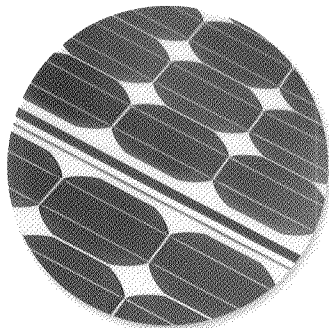
Washington, DC  
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Roger G. Little, Chairman & CEO

## Value Chain



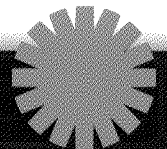
Material Supplies



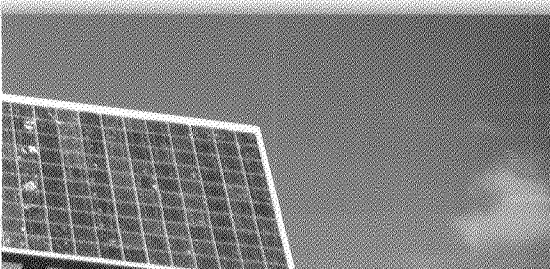
Customer Modules



Spire Solar Systems



**spire**



# A Market Poised for Explosive Growth...

## The Market/Opportunity

Renewable energy is the world's fastest growing market. Trusted and proven technology has combined with the world's need for energy and the political will for a cleaner environment to drive market demand in the solar energy sector. In the first decade of the new millennium, annual solar installations grew from a few hundred megawatts to over 5,000 MW, and this figure is expected to double over the next few years. This has created many commercial opportunities, from the production of solar cells and modules, to energy-producing installations. Spire's established technologies and critical knowledge of the industry uniquely positions the Company in this growing market.

## Continued Growth – New Worlds of PV

During its initial growth phase, the immature PV market was faced with significant supply issues. However, market scale has eliminated most of these problems and industry experts now see a period of unbridled expansion. (Figure 1)

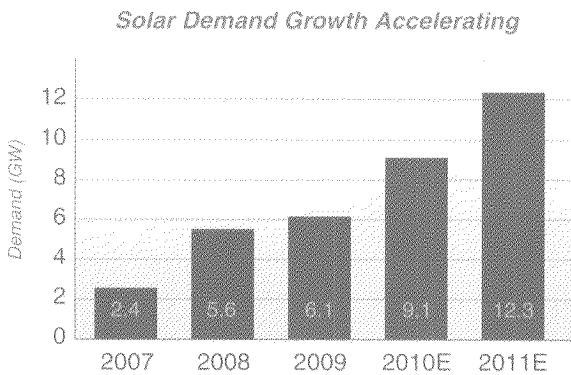


Figure 1 Source: Greentech Media

Although the German and other Western European governments initially dominated the solar market, new markets are opening rapidly. Demand is growing in many emerging economies including China, India and regions of Southeast Asia. Rapidly growing economies, large off-grid populations and subsidies provided for small electrical generation sources (such as kerosene) have intensified the need for solar energy solutions. Regions once known only for their low-cost production have become demand centers for energy consumption.

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*“When it comes to solar these days, it’s go big or go home. Utilities are being pushed to use more renewable energy, heating up the business of large-scale power.”*

– Solar Power Engineering, January 2010

## Market Drivers

The United States (U.S.) is expected to grow faster than any other region, with a sustainable compounded annual growth rate of 50% or greater. Fueled by the American Recovery and Reinvestment Act of 2009 – and combined with numerous state, and municipal incentives to provide job growth – solar energy is among the most common policy objectives at all levels.

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*“U.S. to become the world’s largest solar energy market.”*

– Solarplaza, April 2009



The U.S. will soon become the largest solar market and the one most likely to lead demand growth as we approach and pass grid parity.

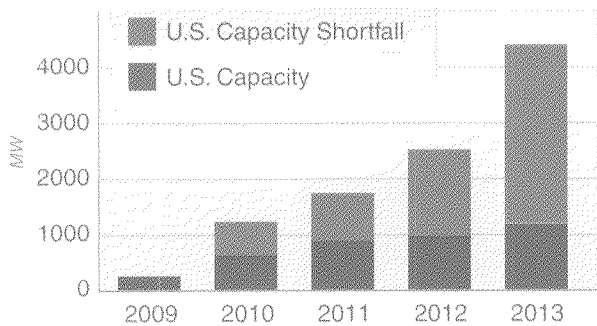
With cost reduced by industry scale, creative financial instruments such as the PPA have emerged to sustain market momentum.

***“The U.S. solar power PPA market will grow from \$700 million in 2009 to \$8 billion in 2013.”***

– Gartner, December 2009

PPAs demand the most secure and trusted technology – crystalline silicon (x-Si). The number of x-Si producers has doubled in less than five years to well over 100 across the globe and is expected to rise in the coming years. Despite this growth, a large and increasing shortfall in capacity will drive manufacturing for solar modules into U.S. locations. **(Figure 2)** This is supported by announcements from many multi-national leaders in solar production from both Europe and China.

***U.S. Market Opportunity: Demand Outpaces Supply***

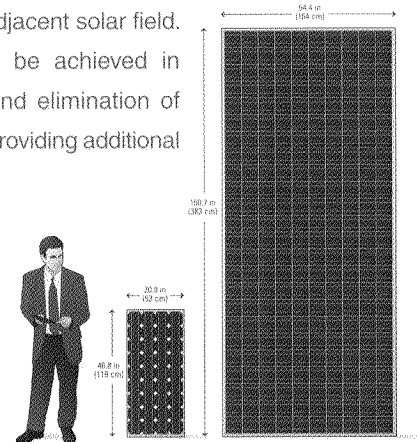


**Figure 2**

**New Markets – Specialized Products**

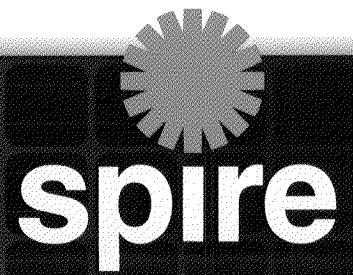
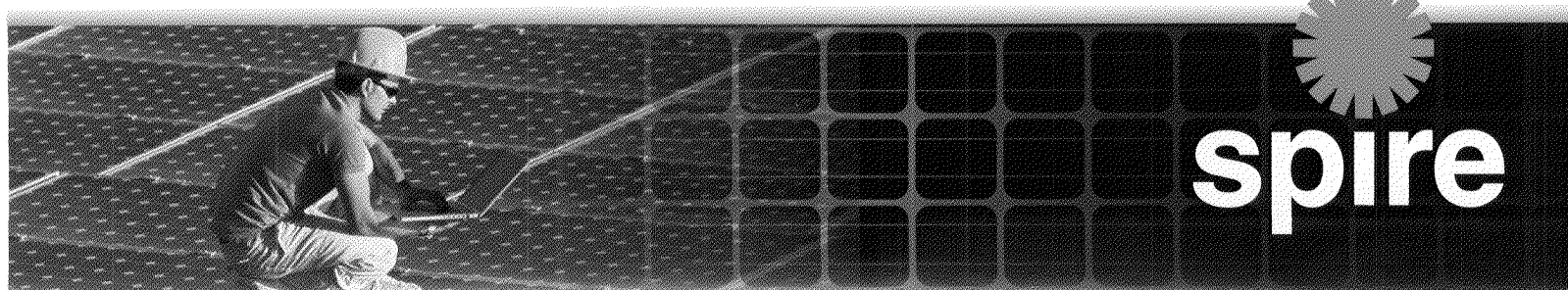
New markets will demand new products to continue the cost reduction that fuels demand. Utility-scale solar power farms will be developed throughout the U.S. and other rapidly growing regions. These large-scale arrays currently utilize existing “standardized” module designs. However, innovative new products and new ways of thinking will be required. To maximize efficiency and drastically reduce costs, a prefabricated factory and turnkey module line can be brought to the solar farm location and manufacturing of modules can be produced at the “farm” site: Cells in the front door and manufactured modules taken out the back door and installed, to plan, in the adjacent solar field. Maximum efficiency will be achieved in production, installation and elimination of module shipping costs – providing additional savings in kW costs.

*The next-generation, super-sized 1 kW module will lower system cost.*



**Figure 3**

Super-sized modules that are 13 times larger than the current designs will enhance the significant cost savings under the factory-to-farm model. **(Figure 3)** To maximize system cost reduction, one large module can take the place of at least four traditional designs, eliminating labor and materials in racking and installing in the farm. With minimal labor, materials and balance of system expenses enormous savings are realized over the life of the array. America is the Land of Solar Opportunity and Spire Solar is uniquely positioned to provide the specialized production facilities, module and system design to panel makers looking to take advantage of the opportunity presented to invest, build and grow in America.



# America: The Land of Solar Opportunity

Sustaining new and existing PV businesses in the emerging American solar market is at the heart of Spire's core competence. With Spire Solar Systems at their side, entrepreneurs quickly notice that sustainability refers equally to their solar enterprise as much as it describes an energy source.

Entrepreneurs, stakeholders and solar veterans alike will have the U.S. under their command when partnering with Spire Solar Systems. From providing individual manufacturing equipment to establishing a comprehensive PV business model, Spire is ideally positioned to place, keep and grow solar enterprises in the U.S.

The U.S. market is virtually untapped – effectively ensuring any size company reasonable market share and longevity. As additional clean energy legislation provides incentives to start renewable energy companies, more entrepreneurs and investors will seek ways to enter or expand in the American solar marketplace. Spire will be there with the best options to find success in this market: we know the trends; we understand the federal, state and local laws with their changing incentives; we have the most comprehensive resources to provide for the changing or evolving demands of our clients.

By extension, Spire Solar Systems consistently pursues its own sustainability as it maintains established partnerships and seeks out prospects in emerging markets such as the U.S. The companies we partner with, or sell equipment to, will continue to need marketing consulting, siting evaluations for expansion and a resource for a steady flow of materials and equipment – all of which Spire Solar Systems provides. Like the sun itself, Spire is the sole source for sustainability in the U.S. PV marketplace.

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***"Spire manufactures the equipment that makes the PV modules.... Spire is widely known for putting new companies into the solar PV business, but also known for allowing a company to evolve with the growth of their needs and the growth of the market."***

– Roger G. Little, Chairman and CEO



# Expansive Knowledge Transfer & Support

## Turnkey Lines

Spire pioneered turnkey lines for module manufacturing and has consistently led the world in photovoltaics. Spire's attention to the commercial success of our customers distinguishes their competitive differentiation and comprehensive product offerings, which led Spire to be bestowed with the Solar Industry Award for "Turnkey Company of the Year Award" in Hamburg, Germany in September 2009.



## Module Lines

Spire's turnkey solar module lines are exceptional in the solar industry. The engineering and expertise offered with its module lines is unprecedented in the industry and includes business planning, factory layout, and job descriptions. All of Spire's module lines may be operated in manual, automated or in fully-automated modes as defined by customers' requirements. These lines are state-of-the-art, providing best in industry turnkey line equipment. Spire offers material supply assistance, complete module design and implementation, as well as factory certification assistance.

Spire completed a 50 MW fully-automated turnkey solar module factory in 2009 for Martifer.

## Cell Lines

Spire offers turnkey solar inline cell lines as well as the necessary factory expertise and engineering. Each cell line is an automated factory utilizing the best in the industry, optimized equipment. These cell lines have been proven to produce the highest quality and efficiency cells – over 16%. To reduce any cracking, breaking and cell defects, Spire has removed manual handling of cells.

Spire exceeded expectations with Hanwha's 30 MW solar cell factory providing cell efficiencies beyond that required by the contractual agreements.



Hanwha

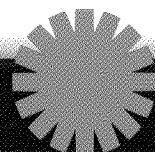
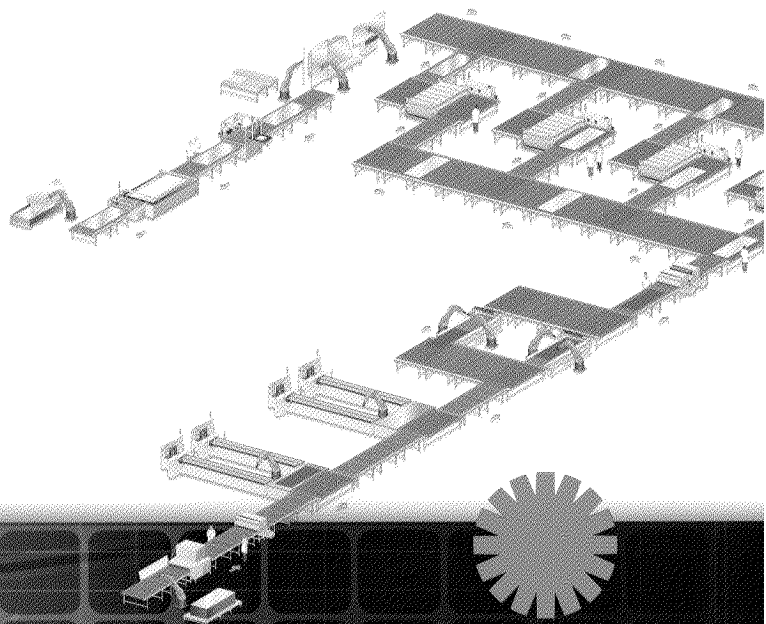
*"We knew Spire represented the best choice as a partner for this turnkey solar cell factory. We have not been disappointed."*

– Hanwha International

**MARTIFER**  
SOLAR

*"It is complex to establish a high-tech automated factory. We are pleased with the support that we received from Spire to reach our designated goals and to achieve unequivocal acceptance."*

– Leandro Bento,  
Factory Manager of Martifer Solar



**spire**



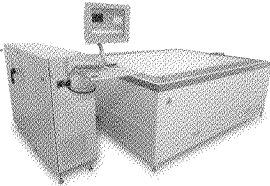
# Quality, Efficiency, Value

## Equipment

Our solar manufacturing equipment is used by 90% of the world's solar module and cell producers. Featured products include:

### Simulator

Sun simulators (flashers) are critical pieces of equipment in solar production lines as well as in testing and certification labs. In a production setting, no module can be sold without passing the tests performed by Spire's Spi-Sun Simulator™. In a testing and research environment, the Spi-Sun Simulator is the primary testing instrument where quality and performance are of utmost importance.



Going beyond class A, Spire Spi-Sun Simulators offer short- and long-term stability over the life of the tool for spectral, spatial and temporal uniformity. Because of the simulator's small footprint and compact size, there are no special facility height or weight restrictions. Spire's simulators have become the industry standard for test agencies and research labs worldwide, including NREL, UL, TÜV, FSEC, CSA, KIER and Bodycote.

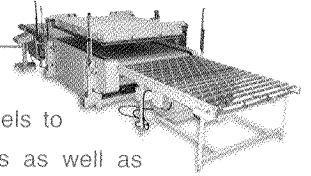


*"We are pleased to have added the advanced solar simulator from Spire Corporation."*

– Mani G. Tamith-Mani, Ph.D.,  
President of TÜV Rheinland PTL

### Laminator

Spire offers the Spi-Laminator™ series in a wide range of models to accommodate all module sizes as well as multiple lamination technologies and options, including fully-automated equipment. As with all of Spire's equipment, the laminators offer Spire customers the lowest cost of ownership over the lifetime of the equipment. The laminators are exceptionally reliable, and Spire has installed over 500 worldwide due to their adaptability to any size line. Currently in development are large-area laminators which Spire has been able to adapt to the market demand for larger modules. In order to reduce the costs of laminators, Spire recently announced their partnership with HHV to build Spire laminators.

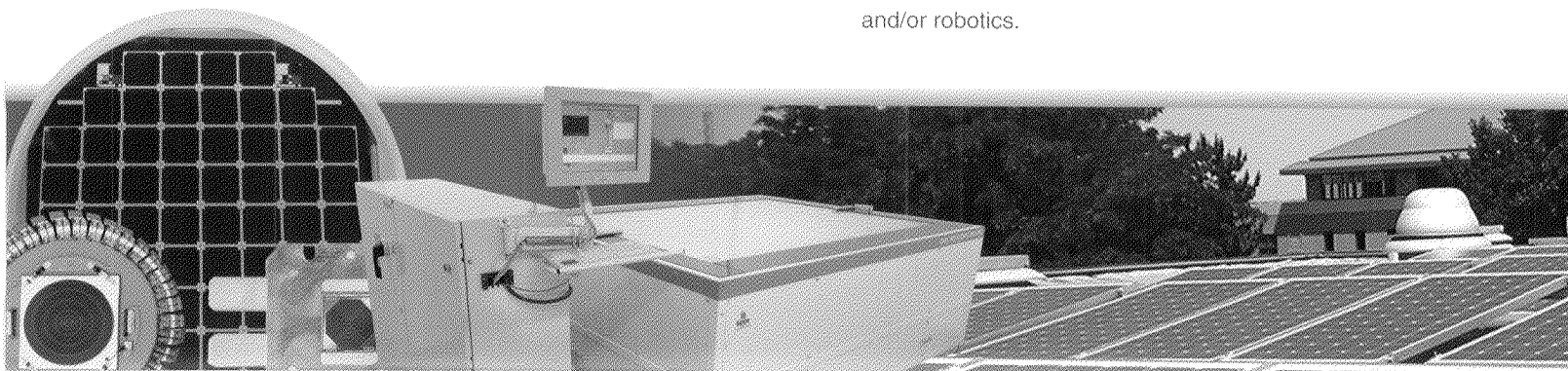
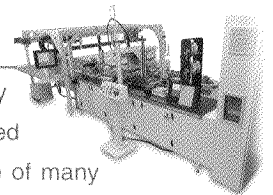


*"Both companies are leveraging their inherent strengths. Our relationship is being built-up in stages and will endure the test of time."*

– Prasanth Sakhamuri, Managing Director of HHV

### Assembler

With over 1 GW of production capacity in the field, Spire Assemblers (automated stringing and tabbing) are the choice of many leading crystalline module manufacturers. Recently, Spire announced the continuous development and improvement to the Spi-Assembler™, which already offers the highest accuracy, throughput and yield as well as high-speed alignment for multiple cell sizes. This machine is quite easily adaptable to any type of line and may be utilized with factory automation, string lay-up, conveyors and/or robotics.

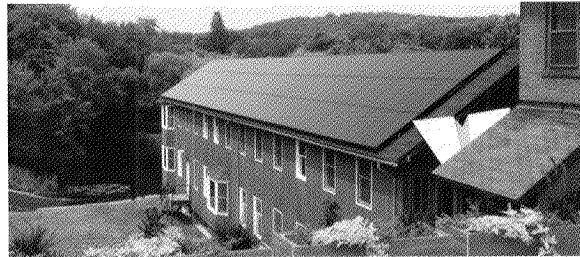




# Solar Energy: Reliable & Clean

## Spire Solar Systems

Spire Solar Systems offers full-service turnkey integration services to commercial and federal markets. These services include installation, site and financial analysis, a complete spectrum of technology, service and manufacturing partners as well as construction, engineering and maintenance serving the commercial and Federal markets.



*“Spire executed our project on time and within budget. They were a pleasure to work with.”*

– Ted Tolis, Senior Architect for Centerbrook and Project Manager for the PV system



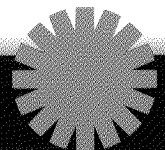
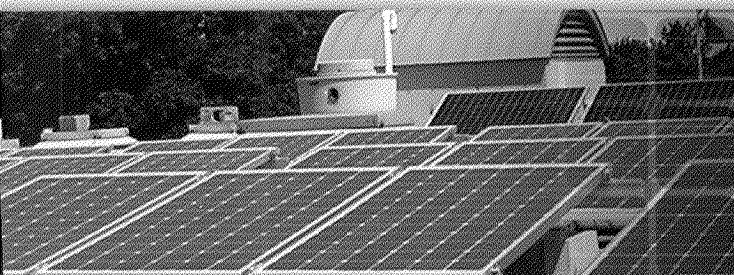
*“We selected Spire Solar Systems because of their experience and longevity in the business, their reputation, and their system design, which offered greater efficiency.”*

– Leighton Lee IV, Facilities Manager, The Lee Company



*“Spire Solar Systems is a tremendous partner. They were on their game about exactly what was going to happen, how we were going to get the system up and running, and what we needed to accomplish it. They held up their side of the equation perfectly.”*

– Norm Stavis, North Coast Seafood, President and CEO



**spire**

# Innovating a Brighter Future

## Research & Development

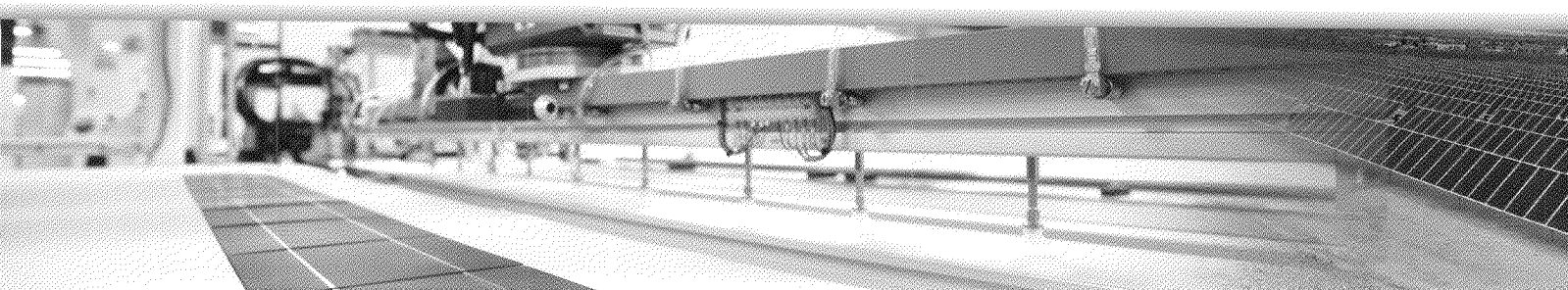
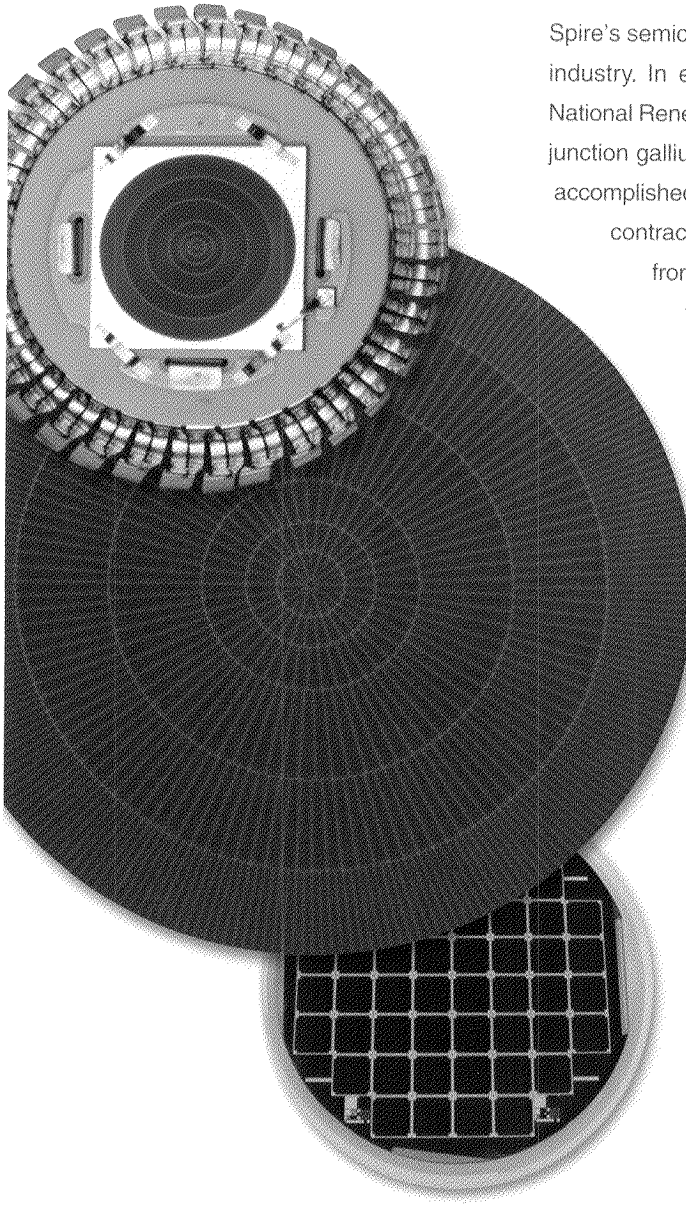
Spire's semiconductor division has over 30 years of experience in the semiconductor industry. In early 2009, Spire Semiconductor was awarded the first phase of a National Renewable Energy Laboratory (NREL) contract to produce 39% efficient triple junction gallium arsenide (GaAs) concentrated photovoltaics (CPV) cells, which was accomplished mid-2009. Subsequently, they were awarded a Phase II follow-on NREL contract to produce 42% efficient cells, which are now being developed. Apart from the NREL contracts, Spire Semiconductor was also awarded \$2 million from The Department of Energy's tax credit program to expand its III/V compound semiconductor manufacturing facility.

*"We are very happy to be given the go ahead with our NREL program. It validates our efforts toward developing a proprietary GaAs concentrator solar cell that exceeds anything commercially available. The PV industry will continue to grow significantly this year and well into the future."*

– Roger G. Little, Chairman and CEO



*NREL has given the green light to Spire Semiconductor to commence Phase II development of triple junction GaAs 42% efficiency "Triathlon" concentrator cells.*



## Executive Officers

### Christian C. Dufresne, Ph.D.\*

Chief Financial Officer and Treasurer

### Stephen J. Hogan

Executive Vice President and  
General Manager, Spire Solar

### Rodger W. LaFavre

Chief Operating Officer

### Robert S. Lieberman, CPA

Chief Accounting Officer

### Mark C. Little

Chief Executive Officer  
Spire Biomedical

### Roger G. Little

Chairman of the Board  
Chief Executive Officer  
and President

### David R. Lipinski

Consulting engineer  
WorleyParsons Limited  
(provider of professional services to the  
energy, resource and complex industries)

### Mark C. Little

Chief Executive Officer, Spire Biomedical  
Spire Corporation

### Roger G. Little

Chairman of the Board, Chief Executive  
Officer and President, Spire Corporation

### Michael J. Magliochetti, Ph.D.

President, CEO, and Director  
Claros Diagnostics, Inc.  
(a point-of-care diagnostic technology firm)

### Guy L. Mayer

President and Chief Executive Officer  
Ascension Orthopedics, Inc.  
(implant technology for the orthopedic  
extremities market)

### Roger W. Redmond, CFA

Vice President and Senior Investment Manager  
Wells Fargo & Company  
(a financial services firm)

## Board of Directors

### Udo Henseler, Ph.D., CPA

President and proprietor  
Management Services International  
(business development services for  
biotechnology and life sciences firms)

\*On March 26, 2010, Dr. Dufresne notified the Company of his intention to resign as Chief Financial Officer and Treasurer. The effective date of his resignation has not yet been determined.

## Selected Financial Data

Years Ended December 31	2009	2008	2007	2006	2005
	(in thousands, except per share amounts)				
<b>Condensed Consolidated Statements of Operations**</b>					
Net sales and revenues	\$69,871	\$64,964	\$37,068	\$20,125	\$22,422
Gain on termination of contracts	3,123	6,761	–	–	–
Gain on sale of trademarks/licenses	–	–	2,735	–	6,320
Income (loss) from continuing operations before income taxes and extraordinary gain	(10,905)	5,725	(4,111)	(8,151)	44
Income tax benefit (provision) – continuing operations	2,241	(270)	877	–	–
Net income (loss) from discontinued operations, net of tax	3,382	(680)	–	–	–
Extraordinary gain, net of tax	–	–	1,301	–	–
Net income (loss)	\$ (5,282)	\$ 4,775	\$ (1,933)	\$ (8,151)	\$ 44
Basic income (loss) per share	\$ (0.63)	\$ 0.57	\$ (0.23)	\$ (1.03)	\$ 0.01
Diluted income (loss) per share	\$ (0.63)	\$ 0.56	\$ (0.23)	\$ (1.03)	\$ 0.01
Weighted average number of common and common equivalent shares outstanding – basic	8,334	8,329	8,272	7,898	6,975
Weighted average number of common and common equivalent shares outstanding – diluted	8,334	8,465	8,272	7,898	7,237

\*\*The Condensed Consolidated Statements of Operations for years 2007, 2006, and 2005 have not been adjusted for discontinued operations.

### Condensed Consolidated Balance Sheets

Cash and cash equivalents	\$ 8,999	\$ 5,971	\$ 2,372	\$ 1,536	\$ 3,630
Total assets	53,393	68,018	48,687	27,684	17,952
Working capital	3,718	6,835	2,587	3,938	5,270
Stockholders' equity	\$ 9,504	\$ 13,518	\$ 8,455	\$ 9,463	\$ 9,255

Certain matters described in this annual report, including those relating to Spire's prospects for growth, constitute forward-looking statements under the federal securities laws. The discussion of forward-looking information requires management of the Company to make certain estimates and assumptions regarding the Company's strategic duration and the effect of such plans on the Company's financial results. These forward-looking statements are subject to risks and uncertainties that could cause actual results to differ materially from those indicated in the forward-looking statements. Such risks and uncertainties include, but are not limited to, the risk of dependence on market growth, competition and dependence on government agencies and other third parties for funding contract research and services, as well as other factors described in the Company's Form 10-K and other periodic reports filed with the Securities and Exchange Commission. Forward-looking statements contained in the annual report speak only as of the date of this annual report. Subsequent events or circumstances occurring after such date may render these statements incomplete or out of date. The Company undertakes no obligation and expressly disclaims any duty to update such statements.

INDEPENDENT REGISTERED PUBLIC  
ACCOUNTING FIRM  
Caturano and Company, P.C. - Boston, MA

GENERAL COUNSEL  
Greenberg Traurig, LLP - Boston, MA

TRANSFER AGENT AND REGISTRAR  
American Stock Transfer and Trust Company, LLC  
New York, NY

### STOCK EXCHANGE INFORMATION

The Company's common stock is traded on the NASDAQ Stock Market under the symbol "SPIR." On March 26, 2010, the common stock was held by 164 persons or entities of record including significant amounts of stock held in "street name." The Company did not pay any cash dividends during 2009 and currently does not intend to pay dividends in the foreseeable future so that it may reinvest its earnings in the development of its business.

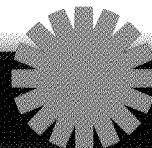
### ANNUAL MEETING OF STOCKHOLDERS

The Special Meeting in Lieu of the 2010 Annual Meeting of Stockholders is scheduled to be held at 10:00 a.m. on Thursday, May 20, 2010 at Spire Corporation, One Patriots Park, Bedford, Massachusetts.

### INVESTOR RELATIONS

For further information about the Company or additional copies of this annual report, Form 10-K or other information, visit the Company's website at [www.spirecorp.com](http://www.spirecorp.com). The Company will provide to any person without charge, upon request, a copy of the Form 10-K. Any person wishing a copy should write to Spire Corporation, Investor Relations, One Patriots Park, Bedford, Massachusetts 01730-2396.

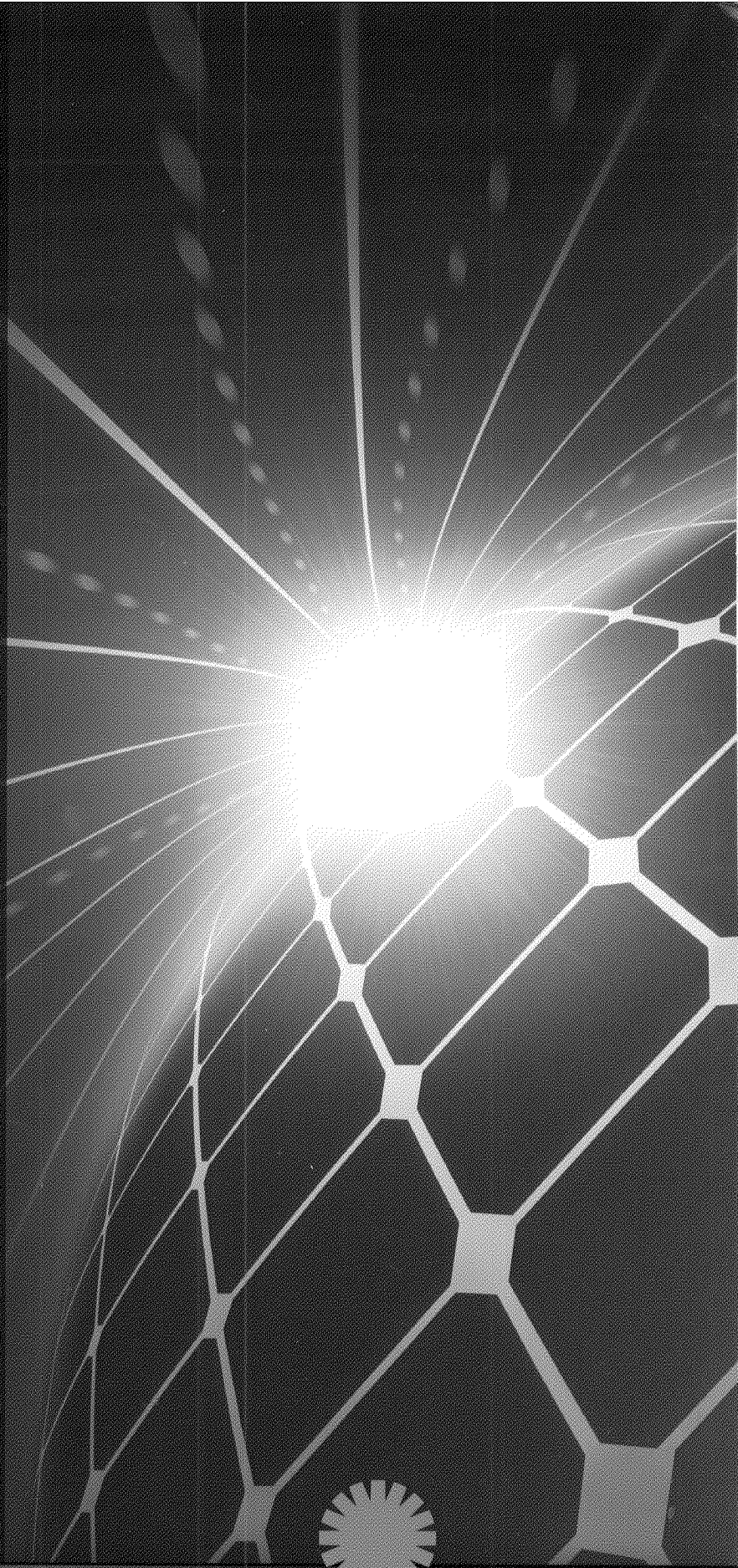
The Company's Form 10-K for the year ended December 31, 2009 filed with the Securities and Exchange Commission, contains an audited consolidated balance sheet of Spire Corporation and subsidiaries as of December 31, 2009 and the related consolidated statements of operations, stockholders' equity and comprehensive loss and cash flows for each of the years in the two-year period ended December 31, 2009.



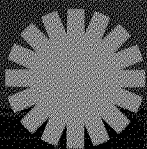
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